Savannah River Site
SNF Strategies

National Spent Nuclear Fuel Program
Strategy Meeting

Gaithersburg, MD
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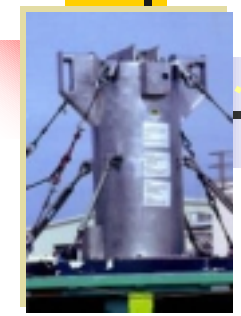
Savannah River Site

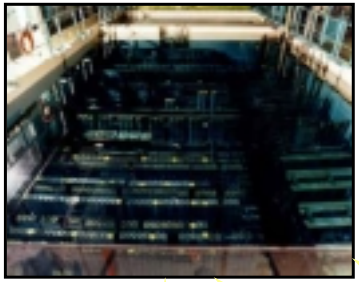
Off-site Cask Receipt Program

Receipt and Storage Facilities



Cask: BMI-1
Owner: DOE
Max. Capacity: 12 MTR
Fleet size: 1

Cask: 18.5T
Owner: JAERI,KUR
Max. Capacity: 30 MTR
Fleet size: 4,2



Cask: MTR-D
Owner: NCS
Max. Capacity: 8 MTR
Fleet size: As required

Cask: LHRL-120
Owner: ANSTO
Max. Capacity: 120 ANSTO (DIDO)
Fleet size: 1

Cask: GE-2000
Owner: GE/DOE
Max. Capacity: 42 MTR, 1 HFIR Core
Fleet size: 3: 2 (GE), 1 (DOE)

Cask: NLI
Owner: NAC
Max. Capacity: 42 MTR
Fleet size: 5

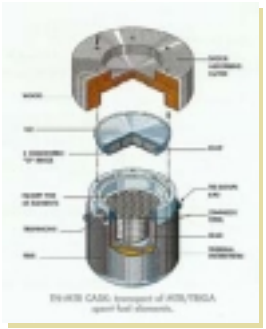
Cask: IU-04 (Pegase)
Owner: Transnucleaire
Max. Capacity: 40 MTR, 36 DIDO
Fleet size: 4

Cask: TN-7/2
Owner: NCS
Max. Capacity: 64 MTR, 60 DIDO
Fleet size: 2

Cask: 20T
Owner: JAERI
Max. Capacity: 30 MTR
Fleet size: 2

Cask: LWT
Owner: NAC
Max. Capacity: 42 MTR
Fleet size: 5

Cask: GNS-16
Owner: NCS
Max. Capacity: 33 MTR, 28 DIDO
Fleet size: 2

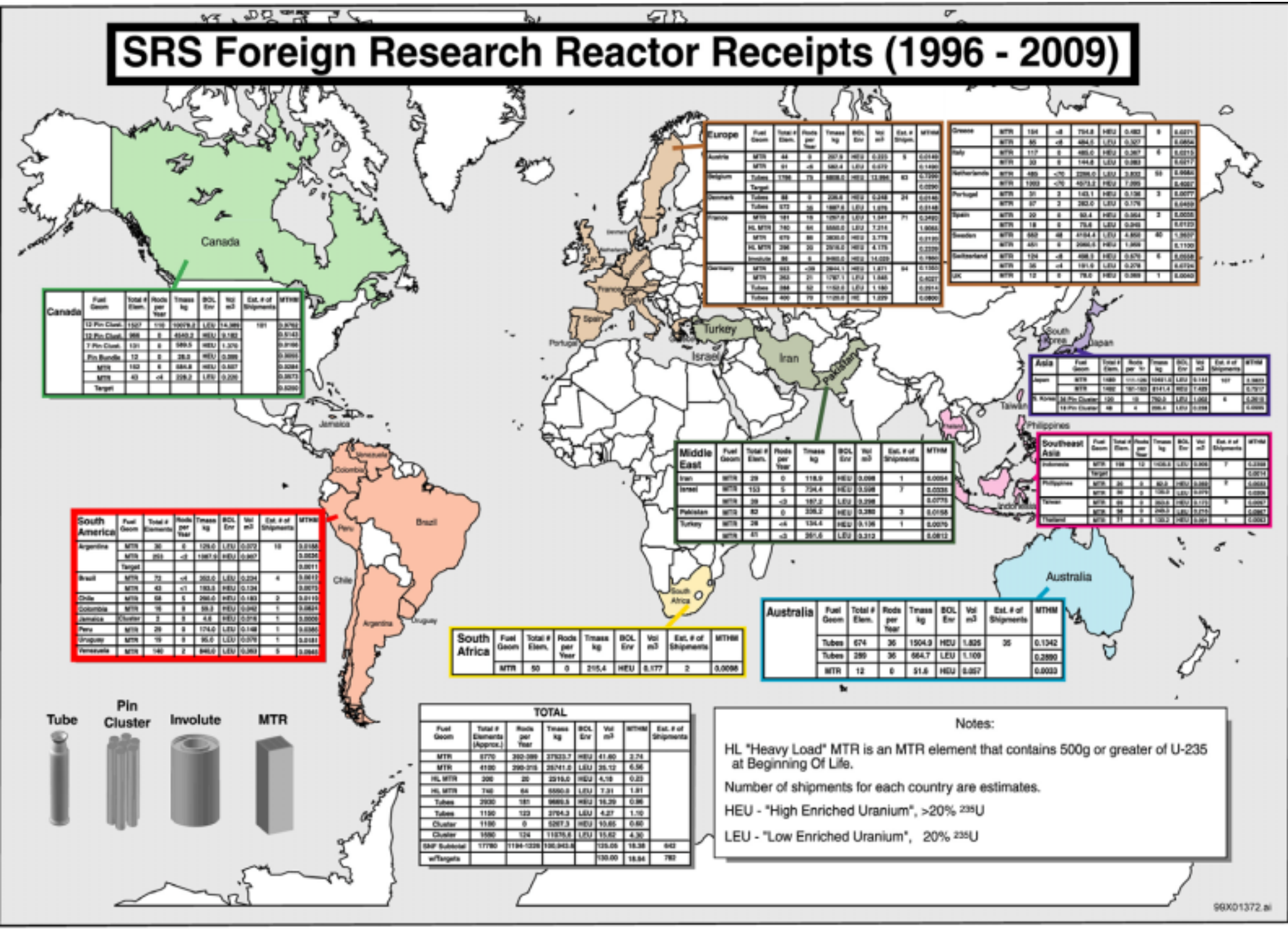


Cask: TN-MTR
Owner: Transnucleaire
Max. Capacity: 68 MTR, 52 DIDO
Fleet size: 3

Cask: TN-6/3
Owner: NCS
Max. Capacity: 1 MTR
Fleet size: 1

Cask: GNS-11
Owner: NCS
Max. Capacity: 33 MTR ,28 DIDO
Fleet size: 2

SRS Foreign Research Reactor Receipts (1996 - 2009)



Canada	Fuel Geom	Total # Elem.	Rods per Year	Tmass kg	BOL Enr	Vol m3	Est. # of Shipments	MTHM
	12 Pin Clust.	1507	110	1007.2	LEU	14.389	101	0.8762
	12 Pin Clust.	966	0	4340.2	HEU	0.182		0.5143
	7 Pin Clust.	131	0	589.5	HEU	1.370		0.0166
	Pin Bundle	12	0	28.0	HEU	0.388		0.0055
	MTR	153	6	684.8	HEU	0.507		0.0084
	MTR	43	<4	209.2	LEU	0.200		0.0073
	Target							0.0200

Europe	Fuel Geom	Total # Elem.	Rods per Year	Tmass kg	BOL Enr	Vol m3	Est. # Shipm.	MTHM
Austria	MTR	44	0	207.9	HEU	0.333	5	0.0140
	MTR	91	<5	560.4	LEU	0.670		0.1490
Belgium	Tubes	1788	75	5808.0	HEU	13.994	63	0.7200
	Target							0.0290
Denmark	Tubes	82	0	226.6	HEU	0.248	24	0.0140
	Tubes	672	35	1887.6	LEU	1.975		0.0140
France	MTR	181	15	1297.0	LEU	1.341	71	0.2490
	HL MTR	192	64	5560.0	LEU	7.314		1.9066
	MTR	670	86	3830.0	HEU	3.778		0.2191
	HL MTR	256	20	2310.0	HEU	4.175		0.2209
	Institute	86	0	8460.0	HEU	14.029		0.1960
Germany	MTR	653	<39	2844.1	HEU	1.871	94	0.1353
	MTR	263	21	1787.1	LEU	1.646		0.0027
	Tubes	288	52	1152.0	LEU	1.180		0.2914
	Tubes	400	70	1126.0	HE	1.229		0.0800

Greece	MTR	154	<8	794.8	HEU	0.483	8	0.0271
	MTR	95	<8	484.0	LEU	0.327		0.0854
Italy	MTR	117	0	485.0	HEU	0.367	6	0.0213
	MTR	33	0	144.8	LEU	0.083		0.0217
Netherlands	MTR	485	<70	2266.0	LEU	2.833	55	0.9684
	MTR	1203	<70	4073.2	HEU	7.095		0.4267
Portugal	MTR	31	2	143.1	HEU	0.136	3	0.0077
	MTR	57	2	282.0	LEU	0.176		0.0459
Spain	MTR	30	0	50.4	HEU	0.064	2	0.0035
	MTR	18	0	75.6	LEU	0.045		0.0123
Sweden	MTR	563	48	4194.4	LEU	4.850	40	1.3637
	MTR	461	0	2066.6	HEU	1.868		0.1100
Switzerland	MTR	124	<8	498.3	HEU	0.670	6	0.0558
	MTR	36	<4	191.0	LEU	0.278		0.0724
UK	MTR	12	0	78.0	HEU	0.069	1	0.0040

Asia	Fuel Geom	Total # Elem.	Rods per Yr	Tmass kg	BOL Enr	Vol m3	Est. # of Shipments	MTHM
Japan	MTR	1488	[illegible]	10461.0	LEU	0.144	101	1.9823
	MTR	1492	197-197	8141.4	HEU	7.485		0.7317
S. Korea	34 Pin Cluster	120	10	792.0	LEU	1.065	6	0.2618
	19 Pin Cluster	48	4	288.4	LEU	0.258		0.0005

Middle East	Fuel Geom	Total # Elem.	Rods per Year	Tmass kg	BOL Enr	Vol m3	Est. # of Shipments	MTHM
Iran	MTR	29	0	118.9	HEU	0.098	1	0.0004
Israel	MTR	153	5	734.4	HEU	0.598	7	0.0335
	MTR	39	<3	187.2	LEU	0.298		0.0775
Pakistan	MTR	83	0	336.2	HEU	0.280	3	0.0158
Turkey	MTR	28	<4	134.4	HEU	0.136	1	0.0070
	MTR	61	<3	361.6	LEU	0.312		0.0812

Southeast Asia	Fuel Geom	Total # Elem.	Rods per Year	Tmass kg	BOL Enr	Vol m3	Est. # of Shipments	MTHM
Indonesia	MTR	156	12	1436.5	LEU	0.808	7	0.3394
	Target							0.0014
Philippines	MTR	24	0	82.8	HEU	0.069	3	0.0053
	MTR	84	0	136.8	LEU	0.079		0.0209
Taiwan	MTR	66	0	264.6	HEU	0.173	3	0.0067
	MTR	54	0	248.3	LEU	0.215		0.0267
Thailand	MTR	31	0	130.2	HEU	0.091	1	0.0063

South America	Fuel Geom	Total # Elements	Rods per Year	Tmass kg	BOL Enr	Vol m3	Est. # of Shipments	MTHM
Argentina	MTR	30	0	129.0	LEU	0.072	10	0.0184
	MTR	253	<3	1387.5	HEU	0.907		0.0834
	Target							0.0011
Brazil	MTR	72	<4	302.0	LEU	0.234	4	0.0611
	MTR	43	<1	193.5	HEU	0.134		0.0073
Chile	MTR	68	5	266.0	HEU	0.183	2	0.0110
Colombia	MTR	16	0	59.2	HEU	0.042	1	0.0024
Jamaica	Cluster	2	0	4.6	HEU	0.016	1	0.0009
Peru	MTR	29	0	174.0	LEU	0.148	1	0.0385
Uruguay	MTR	19	0	95.0	LEU	0.078	1	0.0181
Venezuela	MTR	140	2	840.0	LEU	0.263	5	0.0940

South Africa	Fuel Geom	Total # Elem.	Rods per Year	Tmass kg	BOL Enr	Vol m3	Est. # of Shipments	MTHM
	MTR	50	0	215.4	HEU	0.177	2	0.0098

Australia	Fuel Geom	Total # Elem.	Rods per Year	Tmass kg	BOL Enr	Vol m3	Est. # of Shipments	MTHM
	Tubes	674	36	1504.9	HEU	1.825	36	0.1342
	Tubes	280	36	664.7	LEU	1.109		0.2890
	MTR	12	0	51.6	HEU	0.057		0.0033

Tube

Pin Cluster

Involute

MTR

TOTAL								
Fuel Geom	Total # Elements (Approx.)	Rods per Year	Tmass kg	BOL Enr	Vol m3	MTHM	Est. # of Shipments
MTR	6770	392-399	37533.7	HEU	41.80	2.74	
MTR	4100	290-315	25741.0	LEU	35.12	6.56	
HL MTR	306	20	2310.0	HEU	4.19	0.23	
HL MTR	748	64	5560.0	LEU	7.31	1.81	
Tubes	2930	181	9889.5	HEU	16.29	0.96	
Tubes	1150	123	3794.3	LEU	4.27	1.10	
Cluster	1186	0	5267.3	HEU	10.65	0.60	
Cluster	1680	124	11876.8	LEU	15.62	4.30	
SNF Subtotal	17780	1194-1228	100,943.8		135.00	18.38	642
w/Targets					150.00	18.84	782

Notes:

HL "Heavy Load" MTR is an MTR element that contains 500g or greater of U-235 at Beginning Of Life.

Number of shipments for each country are estimates.

HEU - "High Enriched Uranium", >20% ^{235}U

LEU - "Low Enriched Uranium", 20% ^{235}U

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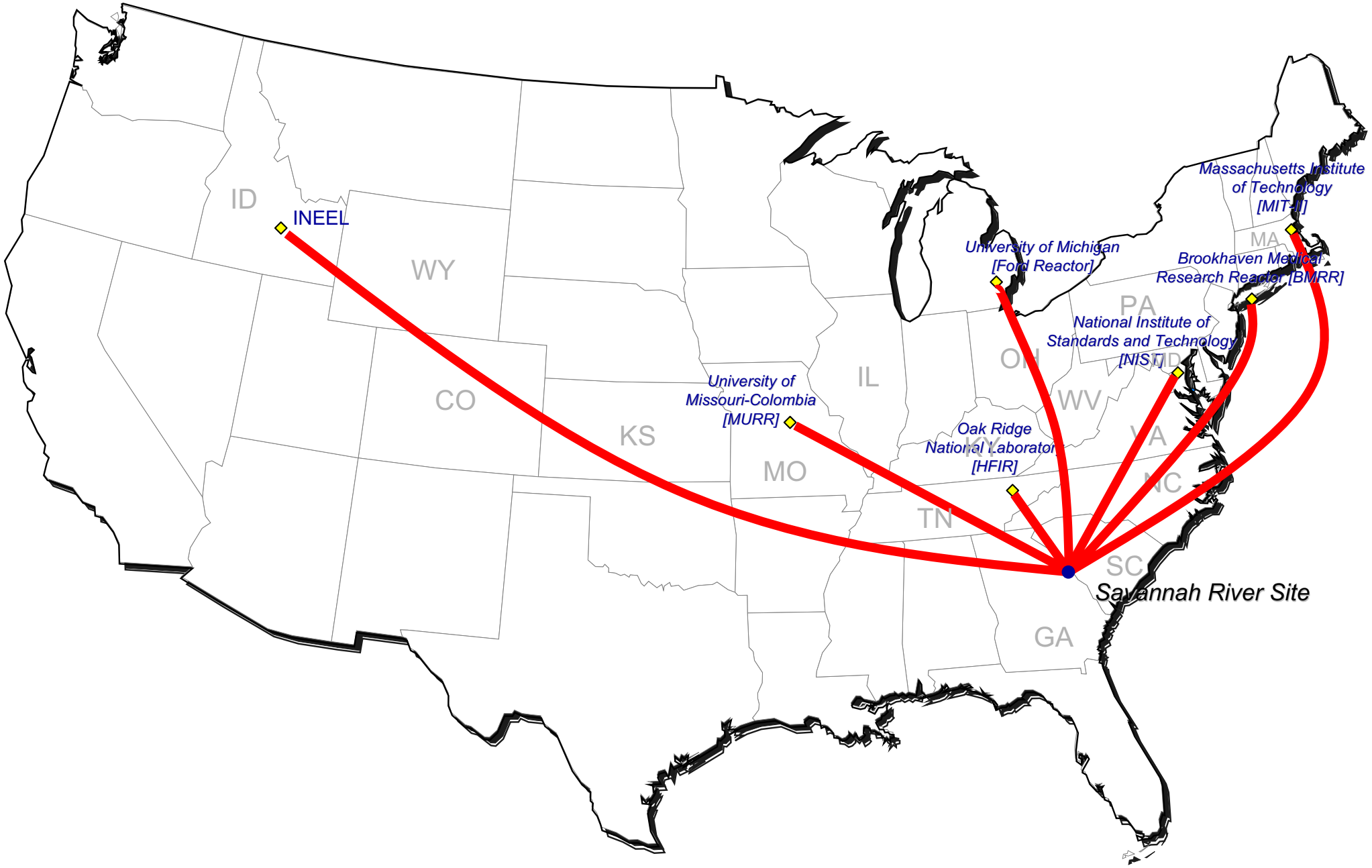
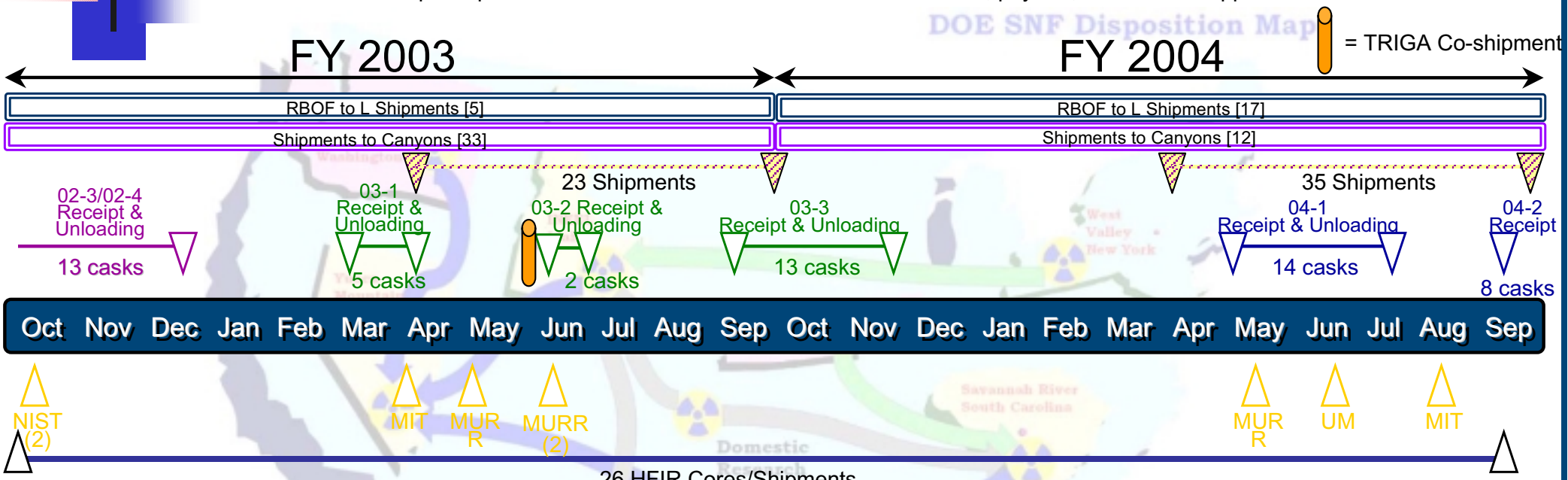
Domestic Research Reactor Stakeholders (FY03)



SRS Spent Nuclear Fuel Receipts Program

FRR Program:
Since the issuance of the ROD in 1996, SRS has received 13 shipments containing ~2600 assemblies from 22 countries. This is approximately 20% of the 13,000 assemblies to be returned from the declared participants of the FRR EIS.

DRR Program:
Domestic shipments from Universities (e.g. MIT) and Government facilities (e.g. HFIR & NIST) will continue to be received through 2035. These reactors provide a vital resource in the research and development of material science, physics, and medical applications.



FRR Shipment 03-1

- Germany, Denmark, France and the Netherlands
- Possibly to receive fuel from SAR-GRAZ

FRR Shipment 03-2

- South Africa
- 1st receipt and will deinventory facility

FRR Shipment 03-3

- Japan, France, and Sweden
- First receipt from Orphee
- First receipt from Toshiba Toshiba (TTR) deinventoried

FRR Shipment 04-1

- Germany, Denmark, Sweden and the Netherlands
- Riso (DR-3) inventory complete
- Australia, South Korea and Indonesia

FRR Shipment 04-2

- Japan

FRR Shipment Canada

- 1st receipts in FY2003
- Target shipments begin in FY2004

DRR Shipments

HFIR Shipments

- Average ~13 shipments per year
- Average ~10 shipments per year after 2010

SRS SNF Facility Status

- RBOF De-inventory: 640 of 836 fuel handling units have been transferred to L-basin
- Although new contract calls for de-inventory in FY04, WSRC is endeavoring to complete this effort by Sept 30, 2003
- FRR Receipts: Sept. 2003 shipment is delayed until Nov. 2003
- DRR Receipts: Temporary USNRC hold on planned shipments
- K-Basin deactivation: Completed

SRS SNF Alternatives

- New Dry Storage (bare) near L-Basin until best alternative decided, with no swap
- Continued Wet storage at L-Basin until best alternative decided, no swap
- Melt-Dilute near L-Basin (baseline) w/ swap
- Direct Disposal near L-Basin, no swap
- H-Canyon will stabilize remaining problematic SNF (legacy irradiated Mk-22/16), with potential transition to NNSA, operating at ~$200M/yr +

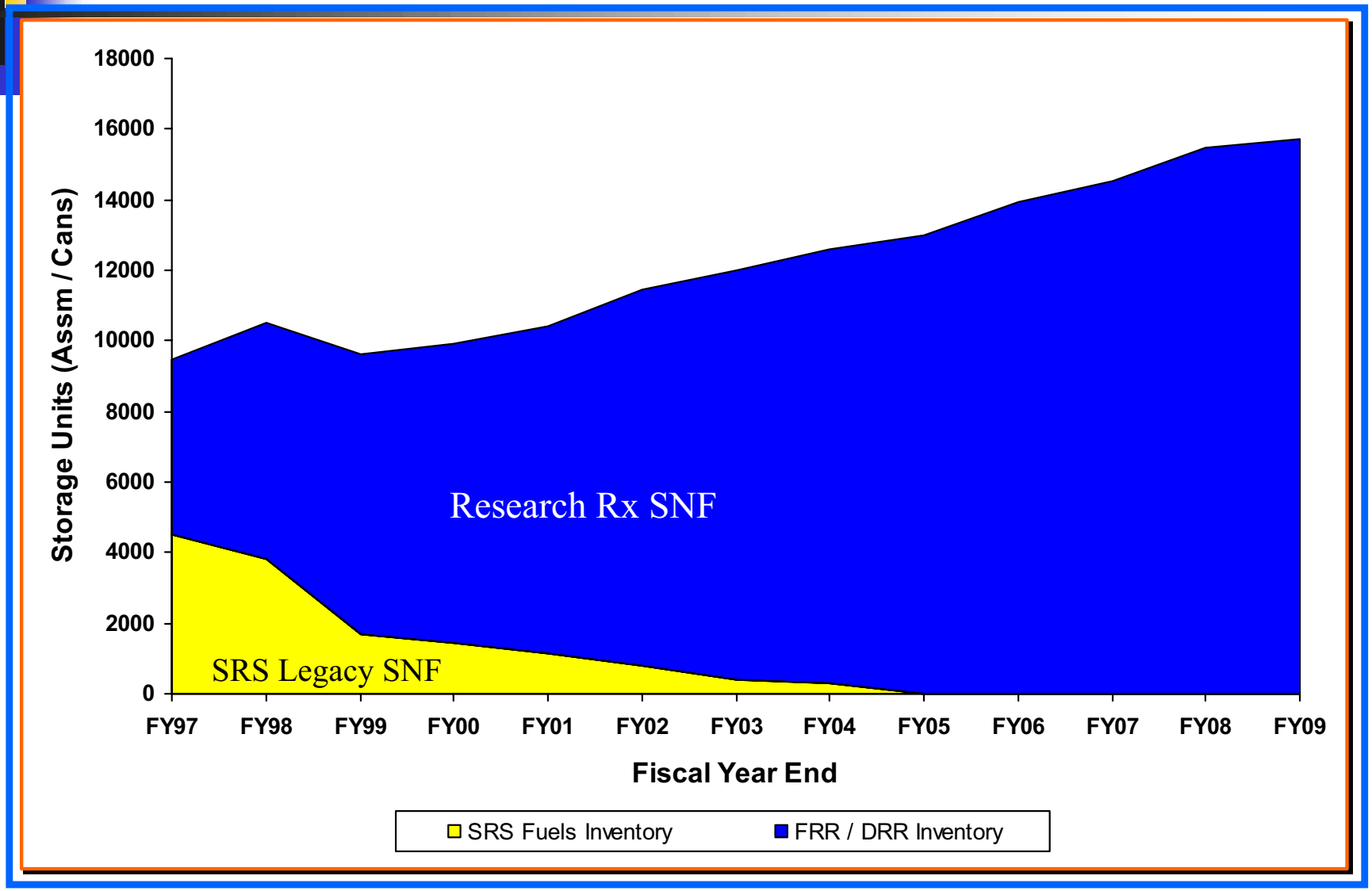
EM Optimized Storage Scenario

- Conversion to dry storage thru 2035
- *What mode of dry? Assumes conversion to dry for cost svgs.*
- Continued off-site receipts
- Some 5.2-1 materials stored - not processed at H-Canyon

L-Basin Utilization

- Direct Disposal with no SNF exchange with INEEL indicates 14,000 MTRE (total inventory) of FRR/DRR and 450 HFIR could be received at SRS
- As currently configured, L-basin is at 78% capacity for MTRE and 48% capacity for HFIR (Full capacity is 11,220 MTRE and 120 HFIR)
- L-Basin Storage Racks project currently underway will raise MTRE capacity to 19,800 and HFIR to 204 cores

SRS SNF INVENTORY



Expanded L-Basin Potential

- Future expanded storage of 28,000 MTRE and 260 HFIR cores (or some trade-off) is feasible using existing L-Basin floor space
- Provided that scrap removal is initiated, walkway and monorail mod's are made, the Dry Cave is utilized for repackaging activities, and additional storage racks
- As a result, MTRE space is never an issue and HFIR space will not be filled until FY17 or later

Unirradiated Nuclear Fuels

- Over 1.6 Metric Tons (U) in SRS wet storage are unirradiated (fresh) and slightly contaminated, and are included in the SRS “SNF baseline”
- These include FRR HEU/LEU and DRR HEU/LEU, representing <10 SC total for repository direct disposal
- Mostly zircalloy clad/UO_2 core, and were at RBOF for storage convenience since the 1970’s, and possibly shipped to INEEL in the proposed exchange
- All major EM SNF sites have examples of unirradiated fuels in inventory, but SRS, RL and INEEL are not planning to ship unirradiated fuel to the repository

Unirradiated Nuclear Fuels (Cont.)

- ~230 contact-handled, irradiated fuel items at SRS with minimal (<1%) burnup and long-cooled as to be identical with unirradiated fuel characteristics (~136 of these are SS clad)
- These materials were never credited in categorization reviews as being self-protecting as a result of burnup, and are still not considered a security issue in existing storage facilities
- May present a security challenge in the new dry storage scenario with transition from wet pools to dry casks
- SRS unfunded plan to investigate lower-cost recycle and/or LLW disposal options to reduce the scope of repository SNF issues at SRS